Remarks

Claims 1-17 were previously pending in this application and claims 18-20 have been newly added to the application. New claims 18- 20 are based on previously disclosed material provided in the specification and therefore no new has been added to the claims or the application.

Claims 1, 2, 5-8, 9-11 and 15-7 are rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over Chu (U.S. Patent 3,481,393 hereinafter Chu '393). Claims 3, 4, 13 and 14 are rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over Chu '393 in view of Galyon et al. (U.S. Patent 5,016,090 and hereinafter Galyon '090). The undersigned respectfully disagrees with these rejections for the reasons discussed below.

First in view of the rejections made to independent claims 1 and 9 and correlating dependent claims 2, 5-8 and 15-17. As discussed in the "Background of the Invention", page 1-2 [0003 and 0004], the application acknowledges that prior art provides for cold plate structures that are placed in thermal contact with electronic devices and are cooled through fluid flow paths that are provided connecting the cold plates to each other and to the external heat exchangers. However, as discussed, the conduit connections are a point of cooling system failures. Special mention to the problems presented by flexible conduits is made in the specification on page 3 [0006] when it is particularly pointed out that plastic tubing cannot be "soldered, brazed, or otherwise reliably and permanently joined to a metal cold plate, a mechanical connection is required between the plastic tubing and each inlet and outlet of each cold plate." This problem of providing for a reliable conduit connection, is in fact, one of the several problems that required resolution in the present instance as discussed by the application.

In addition, a further problem as discussed on page 2 of the specification [0005] is the problem of maintaining adequate thermal contact with all associated electronic devices, especially when the manifold cold plates associated with different types of electronic devices have to respond to the problems of height and geometry as well as different types of electronic devices being used.

Chu ' 393 is a much older patent presented by one of the inventors named in the present application. In Chu '393 a liquid cooling system of modular construction is provided. Each of the electronic components are disposed on one or more conducting backplates 11 which is then "attached thereto a cooling chamber 13 which has a flat head conducting surface 14 of substantially the same area as the flat backplate surface 11." (Col. 2, lines 65-70). As discussed, the flat conducting surface is fitted against the backplate and connected to it and "it is important that the backplate and the conducting side 14 of the cooling chamber is flush so that a good heat conduction path is establish." (Col. 2, line 70 to Col. 3, line 2). In the present invention, this is not the case and the present invention provides for good heat conduction without the restrictions provided above.

As provided in the application page 4[(0009-10] and page 6 [0026] the cooling assembly of the present invention as per embodiment of Fig. 1, includes a plurality of coldplates and correlating nonmetallic conduits 140 which are sealably affixed to these cold plates. This is an important distinction between the present application and Chu '393. The sealably affixing of the nonmetallic conduits to the cold plates leads to a closed environment, unlike in Chu '393, that provides for good heat conduction. In Chu '393, to provide for good conduction, there was a requirement of providing a flat conducting surface and fitting it exactly to the backplatc. The heat conduction achieved through this method is potentially inferior in certain cases to that provided by the present invention, especially if chips and modules of different height and geometry is being used. The end result then is either to forgo using components of different heights and geometry or sacrificing good heat conduction. The requirement of having a conducting surface that is fitted and flushed to the surface of the modules and the backplate is therefore disposed with in the present case.

In the present application, the use of a nonmetallic cold plate cover allows for the enclosure of modules of all geometry while not sacrificing the heat conduction, especially since the nonmetallic cold plate is sealable affixed to the base. This distinction is provided by in claim 1 and claim 9 as "A nonmetallic cold plate cover having at least one cover fluid inlet and at least one cover fluid outlet, said cover being sealably affixed to said base".

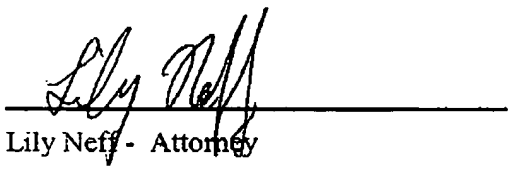
Another distinction as previously pointed to comes in the manner of providing for the fluid flow. While both Chu '393 and the present application provide for flexible conduits that connect fluid inlets to fluid outlets, the manner of connecting these conduits are important as they can potentially lead to cooling system failures when not conducted properly. In Chu '393 as suggested by Fig. 1 and later discussed in the specification, the flexible conduits are connected to the cooling chambers through the use of mechanical means. Fig. 1 shows something that resembles a connector. This and the problem of cooling system failures when using similar approaches is further confirmed in the general discussion presented in Col. 4 in Chu '393. At the beginning of that discussion, as reflected in Col. 4, lines 7-10, it is suggested that in order to maintain cooling system integrity the "input and output connectors 19, 21 are ridged or knurled to apply pressure to the hose 18 placed thereon to prevent its slipping from the conductor unaided."

In the present application, the flexible tubing is bonded to the nonmetallic coldplate cover. As mentioned earlier, the inability to solder, braze or somehow permanently attach a flexible tubing reliably to a metal cold plate was part of the problem being solved here. This has been the reason for prior art often using metallic (i.e. Copper) tubing that lacked the flexibility offered by nonmetallic tubing also available in the prior art. The present invention's design of providing a nonmetallic cover and bonding the nonmetallic flexible conduit(s) to it permanently is a novel design feature that provides both the desired flexibility of the conduit while not sacrificing cooling system integrity. The bonding element provided and discussed here is an element that is both present in independent claim 1 and independent claim 9 as suggested by "a plurality of flexible, nonmetallic fluid distribution conduits in fluid flow communication with said cover fluid inlets and cover fluid outlets, said conduits being bonded to said cover fluid inlets and cover fluid outlets".

Galyon et al. '090 is a cold plate cooling module assembly embodying a crosshatch coolant flow distribution scheme. It provides a cooling scheme by providing two sets of channels which run perpendicular to one another. The first set is formed on a base plate and the second includes a set of inlet channels and a set of interleaved outlet channels formed on a distribution plate. The system provided in Galyon '090 is very different than the approach taken in the present invention or the teachings of Chu '393. In fact it is difficult to practically combine the teachings of Galyon '090 with that of Chu. This is because in Galyon '090, the disclosed cooling structure is designed to remove heat from integrated circuits by providing an indirect impingement cooling scheme. The system in Galyon '090 is not designed to provide a modular cooling system unit as the one suggested by the present application. In fact the Galyon '090 patent expressly provides that its solution is counter to those that use such tubing and conduits by pointing out in Col. 2, lines 7-10 that one of the problems with prior art is that in prior art 'suitable fittings and coolant supply tubing must be provided". Since claims 3, 4 and 13 and 14 are based upon independent base claims that are already discussed and since Galyon '090 as discussed is not even looking to resolve a similar problem as that of the present invention, no further discussion will be made based on this patent with respect to the presented claims in this application.

Applicants submit that in view of the forgoing amendments and remarks, this application and all submitted claims are now in condition of allowance, allowance of which is respectfully requested.

Respectfully Submitted,



Lily Neff - Attorney
Reg. No. 38,254

IBM Corporation, IP Law Dept.
2455 South Rd., M/S P386
Poughkeepsie, NY 12601

Phone: (845) 433-1155
FAX: (845) 432-9786
EMAIL: lneff@us.ibm.com